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THE NORTH AMERICAN PHYLLOPODS OF THE GENUS *STREPTOCEPHALUS*

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SINCE the publication of Packard's monographic treatise of the Phyllopoda in 1883, very little work has been done on the North American species of the genus *Streptocephalus*. This is especially true from a systematic viewpoint. Daday de Dees (1910, pp. 371–375, 409) in his account of the species of *Streptocephalus* repeats the descriptions of the North American forms given by Packard and Ryder. *Streptocephalus similis* Baird, found in the West Indies, is treated much more fully in Daday's monograph. Dodds (1915, pp. 97–98) has recently described what he considers a new species (*S. coloradensis*) of this genus from Colorado. Pesta (1921, pp. 96–98) has described what he considers another new species (*S. americanus*) from Texas. Owing to inadequate descriptions some confusion exists in the synonymy of the species.

The genus *Streptocephalus* is assigned to the order Anostraca of Sars, which groups together those Phyllopoda with pedunculate eyes, eleven, seventeen, or nineteen pairs of swimming appendages, and without a chitinous shield or valve. The family Streptocephalidae of Daday de Dees is character-

ized by having a triarticulate clasping antenna and eleven pairs of swimming appendages. Only the one genus is ascribed to this family at the present time. No fewer than twenty-eight species and subspecies are now known. A subgenus, *Streptocephalopsis,* has been formulated by Daday de Dees to include those species which have the male frontal laminar appendage deeply cleft. The limitations of this subgenus are poorly defined. All North American species are assigned to the subgenus *Streptocephalus.* A further revision seems desirable, especially in reference to the species *Streptocephalus lamellifer* Thiele. It is my belief that the structure of the male cercopods affords a convenient and natural method of grouping members of this genus as now defined. Some cercopods are uniformly setose, others are spined, and still others are flat and plate-like. Such a grouping falls outside the scope of the present paper. As an aid to future revision, however, I urge that all descriptions of species of *Streptocephalus* be accompanied by a figure of the male cercopods, as well as the clasping antenna.

The zoogeography of this genus is most interesting. One species is known in Europe; two occur in Asia; two in North America and one in the West Indies; and twenty-one in Africa and the adjacent island of Madagascar.

KEY TO THE NORTH AMERICAN SPECIES OF *STREPTOCEPHALUS*

1a. Cercopods of male straight with uniform setae throughout their entire length. (See Fig. 6.)

2a. Inner part (the shortest one) of the terminal segment of male clasping antenna with two teeth along anterior proximal margin. (See Figs. 5 and 6.)

Streptocephalus texanus Packard

1b. Cercopods of male bowed, setose along the proximal half of their length and with short curved spines on the distal half. (See Figs. 3 and 4.)

2b. Inner part (the shortest one) of the terminal segment of male clasping antenna with two teeth along anterior proximal margin. (See Figs. 2 and 4.)

Streptocephalus sealii Ryder

2c. Inner part (the shortest one) of the terminal segment of male clasping antenna with three teeth along anterior proximal margin. (See Figs. 1 and 3.)

Streptocephalus similis Baird

Description of North American Species

Streptocephalus texanus Packard

Streptocephalus texanus Packard, Amer. Journ. Sc. Aug., 1871, p. 111.
Streptocephalus watsonii Packard, Hayden's Ann. Rept. U. S. Geol. and Geogr. Surv. Territories, for 1873, p. 622, pl. IV, fig. 13.

Male: Median lamina extending from forehead, faintly lobed; widened at apex. First antenna about twice as long as eye stalk. Upper surface of head bearing a median ocellus or immovable eye. Clasping antenna (Fig. 5) with cylindrical basal joint bearing a lateral protuberance less than 2 mm. long, at junction of second segment. Second segment recurved. Third or terminal segment composed of two parts. Inner part with two unequal teeth along the proximal anterior margin. Distal extension of inner part curved slightly downwards, usually slightly bilobed at apex. Outer part of terminal segment with elongate tooth on the middle of the posterior margin. Distal portion more elongate and curved forwards at almost a right angle. Lateral process of mandible extending to a point above level of attachment of eye stalk. Labrum truncate, with triangular median lamina at apex. Lateral glandular process prominent, situated posterior to lateral mandibular process. Penis tubular, extending to third abdominal segment, counting from last segment with swimming appendages. (The penis is apparently capable of contraction and expansion.) Cercopods of adult males (Fig. 6) tapering, fringed with uniform thick setae on inner and outer margins throughout their entire length. Each cercopod fastened separately to basal abdominal segment. Last abdominal segment, the ninth one, only half the size of the one preceding.

Female dimorphic structures: second antenna composed of an irregularly rounded plate, pointed at apex on the inner

side. Median lamina absent. Ovisac extending to seventh abdominal segment, counting from last segment bearing swimming appendages. Cercopods uniformly setose along margin from point of attachment to apex.

Packard (1883, pp. 346–347) has indicated his reasons for considering *S. watsonii* as a synonym of *S. texanus*. I have examined the cotypes of the former (U.S.N.M. No. 58808) and agree with Packard concerning this point.

Streptocephalus sealii Ryder

Stretocephalus sealii Ryder, Proc. Acad. Nat. Sci. Phil., 1879, p. 200.
(?) *Streptocephalus floridanus* Packard, American Naturalist, Jan. 1880, p. 53.
Streptocephalus coloradensis Dodds, Proc. U. S. Nat. Mus., Vol. 49, 1915, pp. 97–98.
Streptocephalus americanus Pesta, Ann. Naturhist. Mus. Wien, Vol. 34, 1921, pp. 96–98.

Male: Median lamina extending from forehead, branched into two bulbs at apex. Upper surface of head bearing a median ocellus or immovable eye. First antenna twice as long as eye stalk, fringed at apex with setae. Clasping antenna (Fig. 2) with cylindrical basal joint, bearing a filiform process over 3 mm. long on outside at junction with second segment. Second segment recurved. Third or terminal segment composed of two parts. Inner part with two teeth along the proximal anterior margin. Distal extension of inner part curved downwards and uniformly rounded at the apex. Outer part of terminal segment with elongated tooth on the middle of the posterior margin. Distal portion more elongate and curved forward at almost a right angle. Lateral process of mandible extending to a point beyond the level of attachment of eye stalk. Labrum truncate, with a rounded median lamina at the apex. Lateral glandular process situated on segment posterior to lateral mandibular process. Eleven segments posterior to glandular process with swimming appendages. Penis tubular, extending to fourth segment, counting from last segment bearing swimming ap-

pendages. (The penis is apparently capable of being protuded or contracted.) Cercopods of adult males (Fig. 4) bowed, fringed with long setae on the inner and outer margin of the basal half, and fringed with short curved spines on the inner and outer margin of the posterior half. The cercopods are confluent on inner proximal margin. Last abdominal segment, the ninth one, reduced in size, less than half as large as the one immediately preceding.

Female dimorphic structures: second antenna composed of an irregularly rounded plate, pointed at apex on inner side. Ovisac extending to base of seventh abdominal segment, counting from last segment bearing swimming appendages. Cercopods uniformly setose on inner and outer margin from base to apex.

Through the courtesy of Professor J. G. Mackin, I have been able to obtain specimens of this species from a pond near Stratford, Oklahoma. The first specimens sent to me were immature. These agreed perfectly with Packard's description of *Streptocephalus floridanus*. At my request Professor Mackin collected subsequently in the same pond until adults were obtained on May 2, 1929. These proved to be *Streptocephalus sealii*. It is possible that Packard's specimens may have belonged to one of the other species, but the probability is, judging from the distribution of the various species, that he has described immature specimens of *S. sealii* as *S. floridanus*.

Dodds' account of *Streptocephalus coloradensis*, in my estimation, differs so little from Ryder's species that the two forms may be regarded as synonymous. Dodds unfortunately did not describe the cercopods of the male. I have examined the specimens mentioned by him (1915, p. 98) which were collected at Fort Collins, Colorado. This examination confirms the view that *S. coloradensis* Dodds should be regarded as a synonym of *S. sealii* Ryder.

Pesta's description of *S. americanus*, from Dallas, Texas, leaves no doubt that he is dealing with the present species.

He has a very clear idea of the differences between the cercopods of the two continental species.

Ryder's figure of this species, which has been subsequently used by Packard, Pearse, and Daday de Dees, is erroneous in that the teeth which he figures as attached to the longer part of the terminal segment, actually are attached to the smaller part. This point is clear from the description accompanying the wood cut. The crossing of the teeth of the terminal "scissors" of the clasping antenna has been stressed too much, in my estimation, as a condition normal for this species. Fowler's water color drawings of Ryder's types are technically inaccurate. Some of the confusion regarding this species may be due to the above facts.

Streptocephalus similis Baird

Streptoephalus similis Baird, Proc. Zool. Soc. London, Vol. 20, 1852, p. 22.

Male: Median lamina extending from forehead, evenly rounded or slightly bilobed at apex. Upper surface of head bearing a median ocellus or immovable eye. First antenna about twice as long as eye stalk. Clasping antenna (Fig. 1) with cylindrical basal joint, bearing a lateral filiform protuberance, less than 2 mm. long at junction of second segment. Second segment recurved. Third or terminal segment composed of two parts. Inner part with three teeth along the proximal anterior margin. Middle tooth less than half the size of the adjacent teeth. Distal extension of inner part curved downward. Outer part of terminal segment with elongated tooth on the middle of the posterior margin. Distal portion more elongate and curved forward at almost a right angle. Lateral process of mandible extending to a point even with level of attachment of eye stalk. Labrum truncate with a median lamina at apex. Lateral glandular process small, situated posterior to lateral mandibular process. Eleven segments posterior to lateral glandular process with swimming appendages below. Nine abdominal segments; the one to

which the cercopods are attached, triangular in outline. Penis tubular, extending to fifth abdominal segment counting from last segment bearing swimming appendages. Cercopods of adult males (Fig. 3) bowed, fringed with setae on the inner and outer margin of the basal half, and fringed with acute spines on the inner and outer margin of the posterior half. Cercopods not confluent, each part being attached separately to the last abdominal segment.

Female dimorphic structures: second antenna composed of an irregularly rounded plate, pointed at apex on the inner side. Median lamina absent. Ovisac long, extending to eighth abdominal segment counting from last segment bearing swimming appendages. Cercopods uniformly setose on inner and outer margin from base to apex.

The above description is based upon a fine species of specimens from Porto Rico, loaned to me through the courtesy of The American Museum of Natural History.

Ecological and Natural History Notes

Very little is known regarding the ecology or natural history of any of the North American species of this genus. *S. texanus* is reported from "prairie ponds," "cattle holes," "buffalo wallows," and "tanks" or "pot holes." At Satanta, Kansas, this species was taken with *Thamnocephalus platyurus* and a species of *Apus*. In a "tank" or "pot hole" of a red sandstone bluff near Moab, Utah, it was found with *Apus newberryi* and *Leptestheria compleximanus*. In Cimaron County, Oklahoma, *S. texanus* was found in a warm, muddy, cattle hole with *Thamnocephalus platyurus* and *Caenestheriella setosus*.

S. sealii has been recorded by Packard (1883, p. 349) to occur twice during the year in the same pond. W. P. Seals took this species near Woodbury, New Jersey, in June, shortly before the pond in which it was found dried up. It reappeared in the latter part of August, when the pond was again filled by the fall rains.

It is noteworthy that at the present time *S. sealii* and *S. texanus* have not been found together in the same ponds, although the ranges of the two species overlap. It is possible that some ecological or chemical factor of the environment is responsible for this segregation.

GOODE'S SERIES OF BASE MAPS. NORTH AMERICA ON LAMBERT'S AZIMUTHAL PROJECTION. NO. 2.
• S. similis
o S. sealii
+ S. texanus
SCALE
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MAP SHOWING THE DISTRIBUTION OF THE NORTH AMERICAN SPECIES OF THE PHYLLOPOD GENUS *STREPTOCEPHALUS*

S. sealii attains a remarkable size for a fairy shrimp. A male of this species from Pontotoc County, Oklahoma, collected in August by Professor J. G. Mackin, was 36.2 mm. long. A specimen of *S. texanus* collected in June at Satanta, Kansas, measured 21.8 mm. This is the largest specimen that

I have seen of this species. *S. similis* is smaller: the largest specimen that I have examined is only 17. mm. in length.

These animals have no common names. Accordingly, I therefore propose the following: for *S. sealii,* "Spiny-Tailed Fairy Shrimp"; for *S. texanus,* "Smooth-Tailed Fairy Shrimp"; for *S. similis,* "Dominican Fairy Shrimp."

Distribution

The distribution of the various species is indicated on the map contained in this paper. I am unable to find any differences between the specimens of *S. sealii* which I have examined from northern Virginia and those from the region west of the Mississippi River. A locality record for this species in Florida is omitted on the map because of inadequate data. *S. texanus* appears to be rather limited in its distribution. *S. similis* is, at the present time, known only from the islands of Santo Domingo and Porto Rico.

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I am indebted to the authorities of the United States National Museum and the American Museum of Natural History for the loan of many specimens. The General Biological Supply House of Chicago has given me valuable aid in obtaining material. The following have aided in obtaining specimens: Dr. C. T. Vorhies, Dr. F. N. Blanchard, Professor H. K. Gloyd, Professor T. H. Hubbell, and Professor J. G. Mackin. Dr. H. J. Van Cleave has very kindly loaned me some material. This work was carried out under the supervision of Dr. Carl L. Hubbs, to whom the writer is indebted for numerous suggestions in the preparation of the manuscript.

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Explanation of Plates

Figures 1–6 were drawn with the aid of a camera lucida. The figures of *S. sealii* and *S. texanus* are of specimens obtained in Oklahoma. The specimens of *S. similis* figured in this paper were obtained in Porto Rico. The measuring scale under figures 1–6 is equal to one milimeter. Figure 7 is a free hand drawing.

PLATE I

Fig. 1. Clasping antenna of male *S. similis.*
Fig. 2. Clasping antenna of male *S. sealii.*
Fig. 3. Cercopods of male *S. similis.*
Fig. 4. Cercopods of male *S. sealii.*

1

2

3

4

PLATE II

FIG. 5. Clasping antenna of male *S. texanus.*
FIG. 6. Cercopods of male *S. texanus.*
FIG. 7. Drawing of male *S. sealii.*

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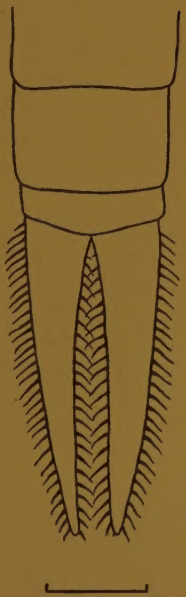

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